CASE STUDY

CONTENTS

Postoperative rehabilitation of a patient with resected aggressive parasagittal meningioma infiltrating the superior sagittal sinus and presenting with paraplegia

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ABSTRACT

The aim of this case report is to describes the postoperative neurological complications and importance of early rehabilitation course of a patient with an aggressive parasagittal meningioma. The particular emphasis on the role of intensive, multidisciplinary rehabilitation in the setting of postoperative spastic paraplegia. The program included physiotherapy, assisted verticalization, gait and locomotion training, proprioceptive neuromuscular facilitation techniques, and psychological support. Clinical status, imaging findings, and functional recovery were evaluated during rehabilitation. A 47-year-old woman with fronto-parietal parasagittal tumor infiltrating the superior sagittal sinus underwent preoperative embolization followed by microsurgical resection. Postoperatively, patient developed bilateral spastic paralysis of the lower limbs, complicated by cerebrospinal fluid leakage and surgical-site infection. After neurosurgical treatment of parasagittal meningiomas involving the superior sagittal sinus severe neurological deficits may occur. This case shows the importance of early, structured and multidisciplinary rehabilitation as an essential component of postoperative care. Early rehabilitation may contribute to functional improvement and preservation of quality of life even in patients with severe motor deficits.

KEY WORDS: neurological deficits, multidisciplinary rehabilitation , physiotherapy, paresthesia

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INTRODUCTION

Parasagittal meningiomas involving the superior sagittal sinus (SSS) (Figure1) a significant clinical and surgical challenge. This is due to their close proximity to the primary motor cortex and the brain's critical venous drainage system [1,2]. Invasion of the SSS increases the risk of perioperative complications. These include cerebral venous infarction, peritumoral brain edema, and postoperative neurological deficits such as motor weakness or paraplegia [2–5]. Although most meningiomas are histologically benign, tumors extending into major dural sinuses tend to behave more aggressively. The presence of bone erosion is also associated with higher morbidity [1,5]. Rehabilitation in this patient group is equally challenging. Neurological deficits after resection of SSS-involving meningiomas often require comprehensive and multidisciplinary care. Such an approach is essential to optimize functional recovery [6–9]. This case report describes a patient with an aggressive parasagittal meningioma complicated by postoperative spastic paraplegia. It also outlines the rehabilitation strategies used to support neurological and functional improvement. Figure 1 shows the parasagittal meningioma involving the superior sagittal sinus

AIM

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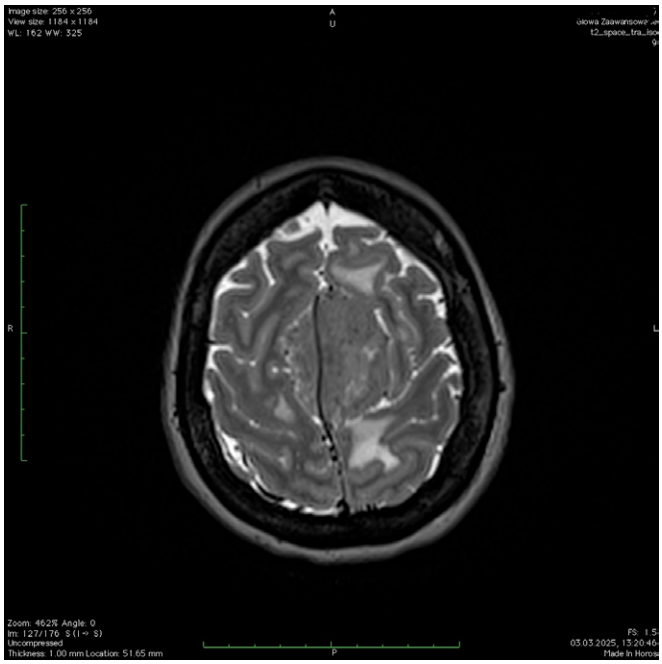

Fig. 1. Parasagittal meningioma involving the superior sagittal sinus
Source :Own materials

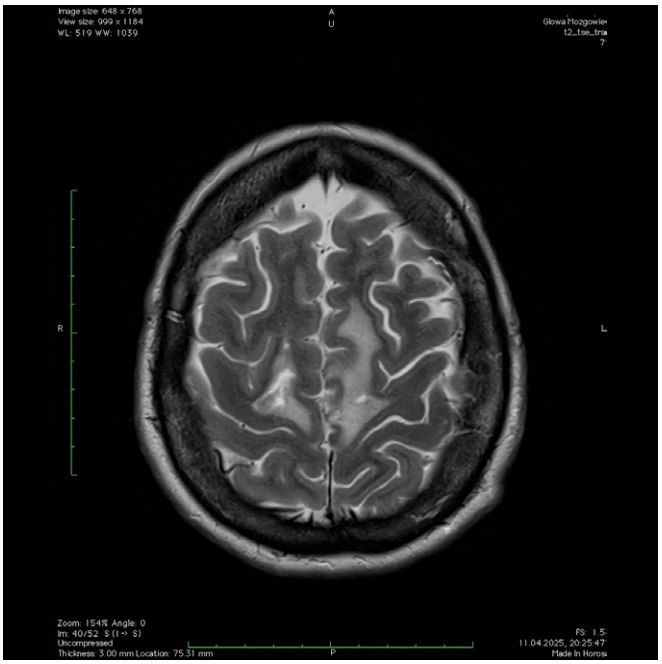

Fig. 2. Postoperative imaging after SSS-involving meningioma resection showing no residual tumour and regression of edema
Source :Own materials

CASE REPORT

A 47-year-old woman with arterial hypertension and type 2 diabetes mellitus presented with new-onset left-sided paresthesia. The symptoms involved the face, upper limb, and lower limb. She also reported chronic lumbar pain. The initial neurological examination revealed a positive Lasègue's sign on the left side.

The first imaging study was a non-contrast CT scan. It revealed a 54 × 50 × 42 mm lesion in the left frontoparietal convexity. A finger-like pattern of peritumoral edema and skull involvement were observed. Subsequent MRI confirmed an aggressively enhancing mass measuring 59 × 58 × 42 mm. The lesion involved the superior sagittal sinus and caused adjacent bone destruction and midline shift. Imaging findings suggested an aggressive meningioma [1, 2].

Preoperative embolization was performed, followed by surgical resection. After surgery, the patient developed spastic paralysis of both lower limbs. She also experienced a cerebrospinal fluid (CSF) leak and a surgical-site infection caused by *Staphylococcus epidermidis* (methicillin-resistant coagulase-negative staphylococci). These complications were treated with targeted intravenous antibiotic therapy, including levofloxacin and vancomycin, followed by linezolid and ceftriaxone. CSF leakage is a known risk factor for postoperative infection after craniotomy [14, 15].

During the rehabilitation phase, the patient underwent an individualized program aimed at improving physical function and psychological well-being. Care was provided by a multidisciplinary team that included physiotherapists, occupational therapists, and mental health professionals. The goal was to support functional recovery and adaptation [6–9].

Psychological intervention included autogenic training to reduce stress and promote mental balance. Supportive psychotherapy was also provided to strengthen coping strategies and maintain motivation during recovery.

The physiotherapy program consisted of targeted interventions. Active exercises were used to improve joint mobility, muscle strength, and overall physical conditioning. Passive verticalization was introduced to safely restore upright positioning. This approach helped adapt the cardiovascular system and prevent orthostatic hypotension [9,11]. Proprioceptive neuromuscular facilitation techniques were applied to enhance motor control and coordination [12]. Passive manual exercises were performed regularly to maintain joint integrity and prevent contractures. Structured gait and locomotion training focused on restoring safe walking patterns, balance, and movement control [6–9, 12].

Follow-up imaging showed no residual tumor and marked regression of edema (Fig. 2). The surgical wound healed well under conservative management. The patient was discharged with a diagnosis of paraplegia, unspecified (ICD-10: G82.2).

DISCUSSION

Tumors of the parasagittal region that invade the superior sagittal sinus (SSS) represent a major neurosurgical and rehabilitative challenge. This is mainly due to their close anatomical relationship with the primary motor cortex and the brain's main venous drainage pathways [1, 2]. The preferred surgical approach is maximum safe resection. Complete tumor removal should be avoided when it carries a high risk of neurological or venous injury [1, 4, 5]. Current consensus guidelines emphasize that preservation of neurological function and venous integrity must take precedence over radical resection in high-risk cases [1].

Invasion of the SSS independently increases perioperative morbidity. Patients have higher rates of cerebral venous infarction, worsening peritumoral brain edema, and new postoperative motor deficits compared with tumors that do not involve the sinus [2–5]. In a retrospective series of 212 patients, the overall perioperative complication rate was 23.6%. Peritumoral edema greater than 1 cm and higher Sindou sinus invasion grades (V–VI) were independent risk factors. Tumor recurrence was more strongly associated with the degree of sinus invasion than with the extent of resection alone [3].

In the present case, several factors likely contributed to the development of postoperative spastic paraplegia. These included large tumor volume, calvarial involvement, and confirmed invasion of the SSS. Preoperative embolization and subsequent microsurgical resection further increased the risk. The most plausible mechanisms were cerebral venous infarction due to impaired sinus or bridging vein flow, worsening peritumoral edema, or direct injury to adjacent motor pathways during surgery [4,5]. Reported rates of symptomatic venous infarction in parasagittal meningioma surgery range from approximately 5% to 10% [4, 5]. Given the severity of the resulting motor deficit, early venous imaging and prompt initiation of rehabilitation were essential to optimize recovery [6–9].

The role of preoperative embolization in hyper vascular meningiomas remains controversial. Its primary goals are to reduce intraoperative blood loss, shorten operative time, and facilitate resection. However, recent studies report mixed outcomes. Some show improved surgical conditions without consistent benefits in functional recovery or recurrence-free survival [10–12]. In this case, embolization was used selectively to support surgery. It should not be considered a predictor of neurological outcome.

Postoperative cerebrospinal fluid (CSF) leakage and surgical-site infection further complicated recovery. CSF leakage is a well-established independent risk factor for infection after craniotomy. The risk is particularly high in cases involving dural reconstruction, devitalized tissue, or sinus manipulation [14, 15]. Optimal management requires early recognition, culture-guided antimicrobial therapy, and careful wound and dural care. These measures help reduce reoperation rates and long-term complications [14, 15].

Rehabilitation played a central role in this patient's recovery. Early, structured mobilization after brain tumor surgery reduces secondary complications such as joint contractures, muscle atrophy, orthostatic intolerance, and pressure injuries. It also promotes faster functional improvement [6–9, 13]. In patients with severe motor deficits and spasticity, assisted verticalization allows safe early upright positioning. This approach limits cardiovascular deconditioning and supports early lower-limb activation and gait training [9, 11, 13]. Available evidence supports the safety and feasibility of such protocols in neuro-oncology and neurocritical care settings [9–11, 13].

Advances in neurorehabilitation highlight the brain's capacity for neuroplastic reorganization, even after major neurosurgical procedures. Patients undergoing brain tumor surgery may achieve meaningful motor recovery despite severe initial deficits. Early and intensive rehabilitation can promote cortical and subcortical reorganization by engaging alternative neural pathways. Reports of functional improvement in patients with benign tumors support this concept [16]. In the present case, task-specific gait training, PNF techniques, and verticalization likely contributed to recovery by enhancing neuroplastic adaptation.

Rehabilitation timing and intensity are also important prognostic factors. Studies show that earlier mobilization, often within two to three weeks after surgery, and higher daily therapy intensity are associated with better functional outcomes and shorter hospital stays [17, 18]. Functional recovery is further influenced by preoperative neurological status, postoperative complications, and comorbidities such as diabetes and hypertension. All of these factors were relevant in this patient. These findings reinforce the need for structured and individualized rehabilitation programs in neurosurgical patients with motor deficits. Rehabilitation should be viewed as an integral component of treatment rather than a supportive adjunct.

Motor relearning approaches such as proprioceptive neuromuscular facilitation (PNF) are well supported in neurorehabilitation literature, particularly in stroke populations. A recent systematic review and meta-analysis demonstrated improvements in

balance and gait speed following PNF-based therapy [12]. Although data specific to post-meningioma deficits are limited, the underlying neurophysiological principles remain applicable. In this case, combining PNF with task-oriented gait and balance training was consistent with established practice and likely contributed to improved mobility.

This case illustrates a modern, integrated approach to the management of meningiomas involving the SSS. Key elements include balanced surgical decision-making, selective use of adjunctive techniques, careful management of postoperative complications, and early multidisciplinary rehabilitation. Together, these strategies increase the likelihood of meaningful functional recovery and improved quality of life, even in the presence of severe neurological deficits.

CONCLUSIONS

This case highlights the complexity of the postoperative course in patients with parasagittal meningiomas involving the superior sagittal sinus. The challenge is particularly evident when severe neurological deficits, such as spastic paraplegia, develop. Despite these complications, early and well-coordinated rehabilitation played a crucial role in preserving functional abilities and supporting gradual recovery.

A comprehensive rehabilitation program combining verticalization, targeted physiotherapy, gait training, and psychological support helped prevent secondary complications and promote motor improvement. This case underscores the importance of timely and individualized rehabilitation as an essential component of care following complex neurosurgical procedures

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

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